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27 April 1970

Materiel Test Procedure 8-2-084
Deseret Test Center

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY ENGINEERING TEST PROCEDURE

GENERATORS, SMOKE, MECHANICAL

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1. OBJECTIVE

The objective of this Materiel Test Procedure (MTP) is to establish uniform procedures for determining and evaluating the technical performance of mechanical smoke generators in terms of the criteria established by applicable Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), and other design requirements and specifications. These procedures will also permit evaluation of the relative safety of test items in the hands of Army troops and the suitability of items for service testing.

2. BACKGROUND

Mechanical smoke generators are used to screen large geographic areas by producing any one of three types of smoke screens, smoke blanket, smoke haze, or smoke curtain. Smoke generators must be capable of being moved rapidly from position to position to take advantage of the prevailing weather conditions.

Because of geographic and tactical conditions, smoke generators are required to function from dug-in positions, trucks, trailers, or boats. They must be able to operate continuously for extended periods and with minimum maintenance in isolated areas which are virtually inaccessible.

The ability of a smoke generator to produce smoke, its size and weight, the simplicity of operation and maintenance, and the logistical support requirements are all important design criteria, and evaluation of these features is an important part of the testing program. The training Army personnel must be given in order to operate the equipment must also be considered in the test program.

3. REQUIRED EQUIPMENT

a. Meteorological Equipment to measure and record:

- 1) Temperature
- 2) Wind direction and speed
- 3) Relative humidity

b. Appropriate test site

c. Smoke observation and sampling equipment

d. Photographic equipment (color, black and white)

- 1) Still
- 2) Motion Picture

e. Type cargo aircraft or simulated equivalent

f. Environmental chambers for:

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- 1) Temperature - humidity testing
- 2) Fungus testing
- 3) Dust testing
- 4) Sunshine testing
- 5) Salt fog testing
- 6) Rain testing
- 7) Water immersion test

- g. Fire fighting equipment
- h. First aid equipment
- i. Accelerometers

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4. REFERENCES

- A. AR 70-38, Research, Development, Test and Evaluation of Materiel for Extreme Climatic Conditions.
- B. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- C. MIL-STD-810B, Environmental Test Methods.
- D. MIL-STD-1472, Human Engineering Design Criteria for Military Systems, Equipment and Facilities.
- E. MIL-H-46855, Human Engineering Requirements for Military Systems, Equipment and Facilities.
- F. USAMCP 706-134, Engineering Design Handbook: Maintainability Guide for Design.
- G. MTP 7-1-002, Air Portability and Airdrop Service Testing.
- H. MTP 7-2-509, Airdrop Capability of Materiel.
- I. MTP 7-2-515, Air Transport (Suitability of Equipment for).
- J. MTP 8-2-500, Receipt Inspection.
- K. MTP 8-2-503, Rough Handling and Surface Transport.
- L. MTP 8-2-512, Leak Testing of Agent-Filled Munitions and Containers.
- M. MTP 8-2-513, Dissemination Characteristics, CB Munitions/Dissemination Devices.

5. SCOPE

5.1 SUMMARY

The procedures required in this MTP are divided into a series of subtests. The sequence may be modified by the test plan. The receipt inspection subtest must be performed first to ascertain the condition of test items as received from their manufacturer; the safety tests should be performed next to reveal any unforeseen hazards; the outdoor performance tests should be performed last. In preparing the test plan, consideration should be given to the number of test items available, their susceptibility to damage, time, availability of facilities, reliability and confidence limits set by QMR and SDR, and budget limitations. Subtests deemed most likely to cause failure should be performed first so that the developing agency may have earliest possible notice of the deficiency.

The following subtests comprise the complete procedure:

a. Receipt inspection - An inspection of the test item as received to (1) determine its physical characteristics and conditions, (2) locate any defects and (3) identify damage received during transport. During this inspection the test items will also be serially numbered for subsequent identification.

b. Safety evaluation - The objective of this procedure is to check the safety statement issued by the developing agency and to identify the safety hazards, if any, which must be included in the safety release recommendation required by reference 4B (USATECOM Regulation 385-6).

c. Simulated environmental testing - A study to determine the effects of extreme temperatures, fungus, humidity, dust, sunshine, fresh and salt water, on the test item.

d. Rough handling and surface transport - A study to determine the effects of rough handling and surface transport on the physical and operational characteristics of the test item.

e. Air transportability - A study to determine the effects of air transport conditions on the physical and operational characteristics of the test item.

f. Airdrop capability - A study to determine the effects on the test item resulting from its being subjected to airdrop conditions.

g. Leak testing - A study to determine if the test item leaks when subjected to standard leak tests and conditions.

h. Operational reliability - A study to determine if the test item meets specified reliability criteria.

i. Dissemination characteristics - A study to determine if the test item meets established criteria for providing screening smoke.

j. Maintenance aspects - A study to determine the ease of performing the required maintenance on the test item and the need for special tools and skills.

k. Human factors aspects - A study to access the ease of transporting, installing, and operating the test item.

l. Electromagnetic radiation (EMR) vulnerability test - A study to ascertain if the test item is adversely affected by EMR.

5.2 LIMITATIONS

The procedures described in this MTP are intended for use only in testing mechanical smoke generators, i.e., devices which evaporate a liquid that condenses into droplets in the air to form an obscuring cloud.

Spray-type smoke generating devices, which disperse droplets of liquid into the air, such as aircraft smoke tanks and jump-type smoke generators, are varieties of chemical agent dissemination devices which are the subjects of other MTP's. Pyrotechnic smoke-generating devices, which produce smoke by combustion of a smoke agent, such as grenades, shells, bombs, smoke pots, and air-delivery smoke dispensers, are likewise the subjects of other MTP's.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Prescheduling Conditions

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- a. Smoke observation and sampling equipment must be available at a suitable test site.
- b. A meteorological forecast must be available before the conduct of each outdoor subtest to prevent wasted effort in unsuitable weather.

6.1.2 Safety Statement

The test officer will ensure that a safety statement has been received from the developing agency before testing is commenced and that it is understood by all test personnel. The safety statement includes information pertaining to the test item's operational limitations and specifies hazards peculiar to the item or components which are to be tested.

6.1.3 Safety Procedures

- a. Test plans and procedures will ensure performance in the safest manner consistent with accomplishing the mission. Plans shall include safety procedures, precautions, protections, and emergency procedures as necessary. Technical information on the hazards and safety characteristics of the test item as provided by the safety statement and other pertinent information shall be included. Such information shall include an evaluation of potential hazards, analysis of risks, limitations, and precautions, including special test equipment and techniques that should be incorporated in test plans and procedures.
- b. One specific individual shall be charged with responsibility for safety. He shall be familiar with the construction and operation of the test item and its critical components, will have full knowledge of the hazards and safety aspects of the test, will review test procedures for evaluation of hazards, and will recommend control measures.
- c. All personnel who participate in or observe the tests shall be briefed on the proper test methods and procedures.
- d. When dealing with flammable liquids, all test personnel must constantly consider not only the hazards which may be encountered during normal conditions, but also those which could be encountered under the worst conditions of malfunctioning, accidents or emergencies.
- e. A record shall be kept of any injuries suffered by test personnel during testing, regardless of how minor they may be and regardless of their relevance to testing.

6.1.4 Security

Security considerations will be determined and provided for as applicable to each of the procedures described in this MTP.

6.1.5 Logistical Requirements

Prior to the conduct of any subtest, the test officer shall ensure that all logistical requirements are satisfied.

6.2 TEST CONDUCT

6.2.1 Receipt Inspection

Subject the test item to the applicable procedures of MTP 8-2-500 following its arrival at the test site, with emphasis on the following:

- a. Visually inspect the test item package/crate and record the following:
 - 1) Binding deficiencies such as broken straps, seals, etc.
 - 2) Packaging material deficiencies such as cuts, tears, breaks, etc.
 - 3) Corroded or mildewed parts
 - 4) Illegible or missing markings
 - 5) Incorrect labeling
- b. Measure and record the external dimensions and weight of the packaged test item.
- c. Unpack the test item and serially number and identify each test item to be used.
- d. Determine and record the following:
 - 1) Preservative
 - 2) Waterproofing
 - 3) Other
- e. Visually inspect the test item and record all deficiencies, specifically the following:
 - 1) Missing components
 - 2) Body cracks or deformation
 - 3) Corrosion of metal parts
 - 4) Missing or outdated inspection records
 - 5) Missing manuals, repair parts, etc.
 - 6) Illegible markings
 - 7) Incorrect assembly of components
- f. Measure and record the external dimensions and weight of the ready-to-operate test item.
- g. Subject the test item to the leak test procedures of paragraph 6.2.7.
- h. Verify the operability of the test item by subjecting it to procedures of paragraph 6.2.8.
- i. Photograph:
 - 1) A complete test item including packages, showing scale
 - 2) Any defective test items

6.2.2 Safety Evaluation

NOTE: This test will be conducted in accordance with all of the safety SOP's and local regulations pertaining to safety, as well as special provisions applicable or peculiar to a specific item or class of items.

Determine the test item's safety by performing the following:

a. Observe the installation and operation of the equipment in accordance with existing instructions, instruction manuals, directives, safety SOP's, and similar guidance. Record hazardous conditions, i.e., jagged edges, under-strength lifting apparatus, etc.

b. Observe for, and record information for inclusion in the safety release required by reference 4B (USATECOM Regulation 385-6).

c. Perform additional checks as required to verify all the safety aspects included in the safety statement prepared by the developing agency. Record deficiencies and recommended inclusions.

6.2.3 Simulated Environmental Testing

6.2.3.1 Extreme-Temperature Tests

Unless obviated by design requirements, the test item will be subjected to the following temperature tests:

6.2.3.1.1 Low-Temperature Test - Place a minimum of 3 test items which have successfully passed the leak test of paragraph 6.2.7 in a test chamber, and perform the following:

a. Reduce the chamber temperature to -45.6°C (-50°F) and maintain it at -45.6°C for a period of 72 hours; and then visually inspect the test items and record any damage.

b. Adjust the chamber temperature to the test item's minimum operating temperature as established by design requirements, and maintain this temperature until stabilization is reached. If stabilization is attained in less than 24 hours, maintain temperature for a complete 24-hour interval. Perform the following:

NOTE: Stabilization, unless otherwise specified, is considered to be reached when the temperature of the test item does not change more than 2°C (3.6°F) per hour.

- 1) Visually inspect the test items, and record damage.
- 2) Remove 1/3 of the test items from the chamber and perform the leak test of paragraph 6.2.7.
- 3) Verify the operability of the item by subjecting it to the procedures of paragraph 6.2.8.
- 4) Obtain photographs as required.

NOTE: Operability checks should be accomplished within 15 minutes of removing the test items from the chamber.

c. Remove the remaining test items from the chamber and allow the test items to stabilize at local ambient conditions, and perform the following:

- 1) Visually inspect the test items, and record damage.
- 2) Obtain photographs as required.

- 3) Subject 1/2 of the test items to the leak test procedures of paragraph 6.2.7.
- 4) Verify the operability of the remaining test item by subjecting it to the procedures of paragraph 6.2.8.

6.2.3.1.2 High-Temperature Test - Place a minimum of 4 test items which have successfully passed the leak test of paragraph 6.2.7 in a temperature chamber, and perform the following:

a. Adjust the temperature of the chamber to 68.3°C (155°F) at a relative humidity of 15 percent, and maintain these conditions for a minimum of 4 hours, and visually inspect the test items and record damage.

b. Adjust the chamber to a temperature of 48.9°C (120°F) and a relative humidity of no more than 15 percent and maintain these conditions for a minimum of 24 hours, and perform the following:

- 1) Visually inspect the test items, and record any damage.
- 2) Remove 1/2 of the test items from the chamber and perform the following:
 - a) Subject 1/2 of the test items to the leak test procedures of paragraph 6.2.7.
 - b) Verify the operability of the remaining test item by subjecting it to the procedures of paragraph 6.2.8.
 - c) Obtain photographs as required.

c. Remove the remaining test item(s) from the chamber and allow them to stabilize at local ambient temperatures and perform the following:

- 1) Visually inspect the test items, and record the damage.
- 2) Subject 1/2 of the test items to the leak test procedures of paragraph 6.2.7.
- 3) Verify the operability of the remaining test item(s) by subjecting it to the procedures of paragraph 6.2.8.

6.2.3.1.3 Temperature Shock Test - Cracking or rupture of materials due to sudden dimensions changes by expansion or contraction are the principals difficulties to be anticipated. These could occur in service due to rapid altitude changes during flight, air shipment, and airdrops.

a. Subject a minimum of 4 test items to Procedure I, Method 503, reference 4C (MIL-STD-810B).

b. At completion of the test, inspect tested items for cracks or ruptures of materials of which it is made.

c. Subject 1/2 of the tested items to the leak test of paragraph 6.2.7.

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d. Subject the remaining tested item to the operability test of paragraph 6.2.8.

6.2.3.2 Fungus Test

a. Subject a minimum of 2 test items to the fungus test or Procedure I, Method 508, reference 4C (MIL-STD-810B).

b. At the completion of the test, perform the following:

- 1) Visually inspect the items and record signs of corrosion.
- 2) Disassemble 1/2 of the test items and inspect the components for the presence of fungus.
- 3) Verify the operability of the items by subjecting the remaining test item to the procedures of paragraph 6.2.8.

6.2.3.3 Humidity Test

a. Subject a minimum of 2 test items to the humidity cycling of Procedure I, Method 507, reference 4C (MIL-STD-810B).

b. At the completion of the cycling period, perform the following:

- 1) Visually inspect the items, and record signs of corrosion.
- 2) Disassemble 1/2 of the test items and inspect the components for corrosion and deterioration.
- 3) Verify the operability of the test items by subjecting the remaining test item to the procedures of paragraph 6.2.8.

6.2.3.4 Dust Test

a. Subject a minimum of 2 test items to the exposure conditions of Procedure I, Method 510, reference 4C (MIL-STD-810B).

b. At the completion of the exposure period, perform the following:

- 1) Visually inspect the test items, and record surface damage noted.
- 2) Disassemble 1/2 of the test items, and inspect the components for damage and presence of dust.
- 3) Verify the operability of the test item(s) by subjecting the remaining test item to the procedures of paragraph 6.2.8.

6.2.3.5 Sunshine Test

a. Subject a minimum of 2 test items to the sunshine conditions of Procedure I, Method 505, reference 4C (MIL-STD-810B).

b. At the completion of the exposure period, perform the following:

- 1) Visually inspect the test items, and record surface damage noted, such as deterioration of natural rubber and plastics.
- 2) Subject 1/2 of the test items to the leak test of paragraph 6.2.7

- 3) Verify the operability of the test items by subjecting the remaining test item to the procedures of paragraph 6.2.8.

6.2.3.6 Water Immersion Test

a. Subject a minimum of 2 test items, fully crated, to the water immersion tests of Procedure I, Method 512, reference 4C (MIL-STD-810B). (If design requirements establish depth of water, water temperature, or time of immersion different from the standard procedure, the test plan will so state).

b. At the completion of the immersion test, remove 1/2 of the test items from their containers, and perform the following:

- 1) Disassemble one of the test items, and inspect its components for evidence of water penetration.
- 2) Subject the remaining test item to the operability test of paragraph 6.2.8.

6.2.3.7 Salt Fog Test

a. Subject a minimum of 3 test items to Procedure I, Method 509, reference 4C (MIL-STD-810B).

b. At the completion of the salt fog spray exposure, perform the following:

- 1) Rinse the test items with clear water.
- 2) Visually inspect the test items for the presence of corrosion.
- 3) Disassemble 1/3 of the test items, and inspect their components for evidence of water penetration and corrosion.
- 4) Subject 1/3 of the test items to the leakage test of paragraph 6.2.7.
- 5) Verify the operability of the test items by subjecting the remaining test item to the procedures of paragraph 6.2.8.

6.2.3.8 Rain Test

a. Subject a minimum of 3 test items to the rain conditions of Procedure I, Method 506, reference 4C (MIL-STD-810B).

b. At the completion of the rain exposure, perform the following:

- 1) Visually inspect the test items for the presence of corrosion.
- 2) Disassemble 1/3 of the test items, and inspect the components for evidence of water penetration and corrosion.
- 3) Subject 1/3 of the test items to the leakage test of paragraph 6.2.7.
- 4) Verify the operability of the test item by subjecting the remaining item to the procedures of paragraph 6.2.8.

6.2.4 Rough Handling and Surface Transport Tests

a. Subject a minimum of 2 test items, packaged in their original containers, to the applicable procedure of MTP 8-2-503 including the following:

- 1) Shock test of paragraph 6.2.2.1a.1
- 2) Vibration test of paragraph 6.2.2.2a.3

b. At the completion of testing, perform the following:

- 1) Examine the test item's packaging for cracks, breaks, undone binding, etc.
- 2) Examine the test items for damage and deformation.
- 3) Subject 1/2 of the test items to the leak test of paragraph 6.2.7.
- 4) Verify the operability of the test item by subjecting the remaining test item to the procedures of paragraph 6.2.8.

6.2.5 Air Transportability

Determine the effects of pressure-altitude and vibration, similar to that which will be experienced by the test item in flight as follows, and the ease of loading/unloading aircraft as follows:

6.2.5.1 Loading and Unloading

Determine the ease of loading and unloading aircraft as described in the applicable section of MTP 7-2-515 or as follows:

NOTE: Background information on air transportability is contained in MTP 7-1-002.

a. Load the test items, in their shipping containers (crate or package), aboard a typical cargo aircraft or simulated aircraft facilities as indicated in the test plan loading schedule, using current standing loading equipment, and record the following:

- 1) Type of aircraft used or simulated
- 2) Shipping container length, width, height, weight, and material
- 3) Equipment used for loading
- 4) Difficulties encountered while loading
- 5) Method of tie/down
- 6) Any damage sustained by the package during loading

b. Unload the test items from the aircraft or simulated aircraft, and record the following:

- 1) Equipment used in unloading
- 2) Difficulties encountered while unloading
- 3) Damage sustained by the shipping container during unloading

6.2.5.2 Simulated Flight Test

a. Subject a minimum of 2 test items, in their shipping containers, to the following conditions simultaneously:

- 1) Ambient pressure at altitude of 50,000 ft. (or maximum altitude at which the test item must be capable of being flown if stated in design requirements).
- 2) Flight vibration conditions as described in the procedures for equipment class g (shipment by common carrier) of Procedure X, Method 514, reference 4C (MIL-STD-810B). The test level will be in accordance with curve AB, figure 514-6, and time schedule IV of table 514-II in the referenced procedure.

b. At completion of the simulated altitude and vibration test, subject the test items to the procedures of paragraph 6.2.4.b.

6.2.5.3 Acoustical Noise Test

The acoustical noise test is conducted to determine the effects on equipment of acoustic sound fields that are characteristics of aircraft, missiles, and other high-performance vehicles.

a. Subject a minimum of 2 test items, in ready-to-use conditions, to the conditions of Procedure I, Method 515, reference 4C (MIL-STD-810B).

b. At the completion of the test, subject the test items to the procedures of paragraph 6.2.4.b.

6.2.6 Airdrop Capability

6.2.6.1 Free Fall Test

NOTE: Perform the following prior to conducting the procedures of paragraph 6.2.6.2.

Subject a minimum of 2 test items, packaged in their original containers to a free fall drop test:

a. Using a crane with a quick release hook raise the test item, over a specified type surface, to the height specified in the test plan.

b. Release the test item and perform the following:

- 1) Examine the test item's packaging for breaks, undone bindings, etc.
- 2) Examine the test item for damage and deformation.
- 3) Verify the operability of the test item by subjecting it to the procedures of paragraph 6.2.8.

6.2.6.2 Airdrop Container Test

Subject a minimum of 2 test items, packaged in their original containers, to the applicable sections of MTP 7-2-509 as follows:

a. Fasten the test item(s), with accelerometers attached to the appropriate parachute or other deceleration device, and release it from aircraft flying at the altitude and speed specified in MTP 7-2-509. Record the following:

- 1) Aircraft type(s) used
 - 2) Aircraft airspeed
 - 3) Altitude above ground
 - 4) Meteorological conditions
 - 5) Impact velocities
 - 6) Deceleration magnitude at impact in g's
- b. Cover the airdrop test procedures with still and motion cameras.
- c. At completion of the test, perform the following:
- 1) Examine the test item's packaging for breaks, undone bindings, etc.
 - 2) Examine the test items for damage and deformation.
 - 3) Subject a suitably determined number of the test items to the leakage test of paragraph 6.2.7.
 - 4) Verify the operability of the test items by subjecting a suitably determined number of the test items to the procedures of paragraph 6.2.8.

6.2.7 Leak Testing

a. Using procedure as described in the applicable portions of MTP 8-2-512 determine if the test item leaks after completing the following subtests:

- 1) Receipt inspection (paragraph 6.2.1)
 - 2) Extreme-temperature tests (paragraph 6.2.3.1)
 - 3) Sunshine test (paragraph 6.2.3.5)
 - 4) Salt fog test (paragraph 6.2.3.7)
 - 5) Rain test (paragraph 6.2.3.8)
 - 6) Rough handling and surface transport tests (paragraph 6.2.4)
 - 7) Simulated flight test (paragraph 6.2.5.2)
- b. Photograph any evidence of damage, leakage, or other failings that have a bearing on the evaluation of the test item.
- c. When leakage is noted, make local repairs if possible, and retest the test item. Record the following:
- 1) Location of leakage
 - 2) Repairs made
 - 3) Effectiveness of repairs

6.2.8 Operational Reliability

- NOTE:
1. Reliability tests will be conducted in accordance with current Army standard practice unless the test item has exceptional characteristics as noted in its QMR, SDR, TC, or other design requirement documents.
 2. The test items undergoing operational reliability testing shall have been subjected previously to the following test procedures:

- a) Simulated environmental testing (paragraph 6.2.3).
- b) Rough handling and surface transport tests (paragraph 6.2.4).
- c) Air transportability tests (paragraph 6.2.5).
- d) Airdrop capability test (paragraph 6.2.6).

a. Select a suitable test site. The test site will meet all safety requirements and be of sufficient area to ensure that screening smoke is confined to the test site.

b. Photograph the operation of the test item at the number of frames per second appropriate to the test item. Record the camera speed.

c. Photograph the smoke cloud produced to provide data for evaluation of test.

d. Record the following for each test item:

- 1) Test item identification number
- 2) Meteorological data:

- a) Ambient temperature
- b) Relative humidity
- c) Wind direction and speed

3) Preliminary preparations:

- a) Nomenclature and description of test item.
- b) Type of installation for this test.
- c) Auxiliary equipment required.
- d) Description of operating cycle.
- e) Description of preoperating procedures.
- f) Description of method of ignition.
- g) Time elapsed between initial preparation and smoke production.
- h) Number and training levels of personnel required to install and operate equipment.

4) Operational data:

- a) Noise level
- b) Fuel consumption and type
- c) Description of fuel containers
- d) Fuel additives for various temperatures
- e) Special procedures required for cold-weather operation
- f) Operating time for one complete fuel load
- g) Length, width, height, opacity, and duration of smoke cloud
- h) Electrical power input
- i) Operating pressures
- j) Flow rates
- k) Type of operating fluid
- l) Nozzle characteristics

e. At the completion of operational reliability tests, record the following:

- 1) Number of smoke generators tested
- 2) Number of nonfunctioning generators
- 3) Reason for nonfunctioning or malfunctioning, if known

f. Evaluate operation manual and instruction plates for accuracy and completeness.

6.2.9 Dissemination Characteristics

NOTE: This particular subtest is essentially nonreproducible because of the variability of the many atmospheric conditions which affect dissemination characteristics.

a. Determine the dissemination characteristics of test items as described in the applicable portions of MTP 8-2-513.

b. In addition to the data collected above, record the following:

- 1) Description of sampling techniques.
- 2) Results of sampling and analysis.
- 3) Description of smoke screen and dispersion characteristics.
- 4) Lighting relationship of observers (cameras), smoke screen, and illumination source.
- 5) Photometer readings of incident and reflected light from cloud and from background.
- 6) Type of background (trees, rock, water, etc.) and color.
- 7) Type of surface in foreground and beneath smoke screen (soil, rock, water, grass, etc.) and color.
- 8) Meteorological data consisting of:
 - a) Temperature and temperature gradient
 - b) Barometric pressure
 - c) Wind velocity
 - d) Relative humidity
 - e) Cloud conditions

c. Obtain motion pictures of the testing from initial functioning to final screen dispersion.

d. Evaluate the adequacy of the smoke cloud's screening ability.

6.2.10 Maintenance Characteristics

NOTE: Background information on checking a test item to determine its maintenance aspects is contained in reference 4F (USAMC Pamphlet 706-134).

a. Inspect the test item for deficiencies which will require replacement of components before the item can be tested. Photograph all deficiencies.

b. Complete authorized maintenance tasks in accordance with the test item maintenance manuals, instructions, etc.

c. Record the time and personnel required to perform scheduled and

nonscheduled maintenance tasks throughout the period of testing.

d. Determine the accuracy and evaluate the adequacy of the test item maintenance package.

e. Note whether special tools or skills are required.

f. Record the following:

- 1) Test item down time (cumulative)
- 2) Time taken between repairs and reasons, if appropriate
- 3) Frequency of repairs
- 4) Nomenclature of repair parts used

g. Evaluate the test item design from maintainability standpoint as applicable.

6.2.11 Human Factors Aspects

Throughout the conduct of this MTP, observations will be made regarding the human factors engineering characteristics of the test item.

NOTE: Background information on human factors engineering testing is available in reference 4D (MIL-STD-1472) and reference 4E (MIL-H-46855).

Specific areas of observations will include the following:

a. Compatibility with field clothing and equipment, particularly with protective clothing, arctic clothing, etc.

b. Simplicity and adequacy of operating instructions.

c. Conformance of the test item's design to qualitative requirements, particularly whether it is as compact and light as possible commensurate with functional characteristics.

d. Legibility of identification markings.

e. Reactions of test personnel to design features when operating equipment.

f. Ease of identifying items and components under daylight, darkness, and blackout conditions.

g. Need for special tools or special handling.

6.2.12 Electromagnetic Radiation (EMR) Vulnerability Test

a. The test officer shall familiarize himself with the test item and with the instrumentation and calibration of electroexplosive devices (EED's).

b. Measure and record the frequencies where effects shall most likely occur.

c. Instrument the bridgewire of an EED to monitor and record its temperature.

NOTE: The EED bridgewire temperature is proportional to the amount of current flow and can be calibrated by passing known currents through the bridgewire.

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- d. Arrange a suitably determined number of test items in various configurations as specified in the test plan or as determined in step a. above.
- e. Apply electromagnetic radiation for each frequency determined in step b. above.

NOTE: Only the most effective polarity will be used. In areas of apparent resonance, both horizontal and vertical polarities will be investigated in accordance with applicable criteria as established by the test item's design requirements or by the test plan.

f. Record the following:

- 1) Frequencies of operation
- 2) Polarity of radiated signal
- 3) Temperature of the EED bridgewire
- 4) Any ignition or other evident effect of EMR on the test items

6.3 TEST DATA

6.3.1 Receipt Inspection

a. Record the data collected as described in applicable sections of MTP 8-2-500 and the following:

1) For the test item package:

- a) Binding deficiencies such as broken straps, seals, etc.
- b) Packaging material deficiencies such as cuts, tears, breaks, etc.
- c) Corroded or mildewed parts.
- d) Illegible or missing markings.
- e) Incorrect labeling.
- f) Length, width, height, in feet and inches.
- g) Weight, in pounds.

2) For the test item:

All deficiencies of the test item, specifically the following:

- a) Missing components.
- b) Incorrect assembly of components.
- c) Body cracks or deformation.
- d) Corrosion of metal parts.
- e) Missing or outdated inspection records for pressure rating tests of tanks, hose, etc.
- f) Missing manuals, repair parts, etc.
- g) Preservative, waterproofing, other protective material.
- h) Height, width, and length, in feet and inches.
- i) Weight, in pounds.

- 3) Leakage data collected as described in paragraph 6.2.7.
- 4) Operability data collected as described in paragraph 6.2.8

b. Retain all photographs.

6.3.2 Safety Evaluation

Record the following:

a. Hazardous features:

- 1) Physical
- 2) Operational
- 3) Action taken to reduce or eliminate

- b. Data collected for inclusion in safety release recommendation
- c. Types of fire fighting equipment
- d. Deficiencies in safety devices

6.3.3 Simulated Environmental Testing

6.3.3.1 Extreme Temperature Tests

6.3.3.1.1 Low-Temperature Tests

a. Record the following for each test item, as applicable:

- 1) Test item identification number
- 2) Damages incurred at a temperature of -45.6°C (-50°F)
- 3) For test item minimum operating temperature
 - a) Damages incurred.
 - b) Leakage data collected as described in paragraph 6.2.7.
 - c) Operability data collected as described in paragraph 6.2.8.
 - d) Temperature in $^{\circ}\text{C}$.
- 4) For ambient temperature:
 - a) Damages incurred
 - b) Leakage data collected as described in paragraph 6.2.7
 - c) Operability data collected as described in paragraph 6.2.8
 - d) Temperature in $^{\circ}\text{C}$

b. Retain all photographs

6.3.3.1.2 High-Temperature Tests

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a. Record the following for each test item, as applicable:

- 1) Test item identification number
- 2) Damages incurred at a temperature of 68.3°C (155°F):
- 3) For temperature of 48.9 ° C (120F):
 - a) Damages incurred.
 - b) Leakage data collected as described in paragraph 6.2.7.
 - c) Operability data collected as described in paragraph 6.2.8.
 - d) Temperature in ° C.
- 4) For ambient temperature:
 - a) Damages incurred.
 - b) Leakage data collected as described in paragraph 6.2.7.
 - c) Operability data collected as described in paragraph 6.2.8.
 - d) Temperature in ° C.

b. Retain all photographs

6.3.3.1.3 Temperature Shock Test

Record the following for each test item:

- a. Test item identification number
- b. Damages incurred, cracks, or ruptures of materials
- c. Leakage data collected as described in paragraph 6.2.7
- d. Operability data collected as described in paragraph 6.2.8

6.3.3.2 Fungus Test

Record the following for each test item:

- a. Test item identification number
- b. Presence of fungus growth on:
 - 1) Test item
 - 2) Test item components
- c. Operability data collected as described in paragraph 6.2.8

6.3.3.3 Humidity Test

Record the following for each test item:

- a. Test item identification number
- b. Evidence of corrosion and deterioration on:

- 1) Test item
- 2) Test item components

c. Operability data collected as described in paragraph 6.2.8

6.3.3.4 Dust Test

Record the following for each test item:

- a. Test item identification
- b. Damage to:
 - 1) External surface
 - 2) Test item components
- c. Presence of dust on test item components
- d. Operability data collected as described in paragraph 6.2.8

6.3.3.5 Sunshine Test

Record the following for each test item:

- a. Test item identification number
- b. Damage to:
 - 1) External surface
 - 2) Test item components
- c. Leakage data collected as described in paragraph 6.2.7
- d. Operability data collected as described in paragraph 6.2.8

6.3.3.6 Water Immersion Tests

Record the following for each test item:

- a. Test item identification number
- b. Operability data collected as described in paragraph 6.2.8
- c. Evidence of water penetration

6.3.3.7 Salt Fog Test

Record the following for each test item:

- a. Test item identification number
- b. Evidence of corrosion:
 - 1) Test item
 - 2) Test item components
- c. Evidence of water penetration

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- d. Leakage data collected as described in paragraph 6.2.7
- e. Operability data collected as described in paragraph 6.2.8

6.3.3.8 Rain Test

Record the following for each test item:

- a. Test item identification number
- b. Presence of corrosion:
 - 1) Test item
 - 2) Test item components
- c. Evidence of water penetration
- d. Leakage data collected as described in paragraph 6.2.7
- e. Operability data collected as described in paragraph 6.2.8

6.3.4 Rough Handling and Surface Transport Tests

Record the following for each test item:

- a. Test item identification number.
- b. Data collected as described in applicable sections of MTP 8-2-503.
- c. Damage to the test items package (cracks, breaks, undone binding, etc.).
- d. Damage and deformation to test item exterior.
- e. Leakage data collected as described in paragraph 6.2.7.
- f. Operability data as described in paragraph 6.2.8.

6.3.5 Air Transportability

6.3.5.1 Loading and Unloading

Record the data collected as described in applicable sections of MTP 7-2-515 or the following:

- a. Type of aircraft used or simulated
- b. Shipping container:
 - 1) Length, width and height, in inches
 - 2) Weight, in pounds
 - 3) Material
- c. Equipment used in loading
- d. Difficulties encountered while loading
- e. Damage incurred to the package while loading
- f. Method of tie/down
- g. Equipment used in unloading
- h. Difficulties incurred in unloading
- i. Damage incurred to the package while unloading

6.3.5.2 Simulated Flight Test

Record the following for each test item:

- a. Test item identification number
- b. Altitude simulated in feet
- c. For test shipping container:
 - 1) Presence of cracks, breaks, etc.
 - 2) Undone bindings, if applicable
- d. Damage and deformation to the test item's exterior
- e. Leakage data collected as described in paragraph 6.2.7
- f. Operability data collected as described in paragraph 6.2.8

6.3.5.3 Acoustical Noise Test

Record the following:

- a. Leakage data collected as described in paragraph 6.2.7
- b. Operability data collected as described in paragraph 6.2.8

6.3.6 Airdrop Capability

6.3.6.1 Free Fall Test

Record the following for each item tested:

- a. Test item identification number
- b. Height of fall in feet and inches
- c. Type of surface (metal, wood, etc.)
- d. For test item package:
 - 1) Packaging material used
 - 2) Presence of cracks, breaks, etc.
 - 3) Undone binding
- e. For test item:
 - 1) Damage or deformities
 - 2) Operability data collected as described in paragraph 6.2.8

6.3.6.2 Airdrop Container Tests

- a. Record the following for each test item:
 - 1) Data collected as described in applicable sections of MTP 7-2-509.
 - 2) Test item identification number.
 - 3) Altitude (in feet).
 - 4) For test shipping container:

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- a) Presence of cracks, breaks, etc.
- b) Undone bindings, if applicable
- 5) Damage and deformation to the test item's exterior
- 6) Leakage data collected as described in paragraph 6.2.7
- 7) Operability data collected as described in paragraph 6.2.8
- 8) Aircraft type(s) used
- 9) Aircraft airspeed in mph
- 10) Meteorological conditions
- 11) Impact velocity in fps
- 12) Accelerometer data

b. Retain all photographs

6.3.7 Leak Testing

a. Record the following:

- 1) Location of leakage
- 2) Repairs made
- 3) Effectiveness of repairs

b. Retain all photographs

6.3.8 Operational Reliability

a. Record the following:

1) For each test item performance:

- a) Test item identification number
- b) Camera speed in frames per second
- c) Meteorological data:

- (1) Ambient temperature
- (2) Relative humidity
- (3) Wind direction and speed

d) Preliminary preparations:

- (1) Nomenclature and description of test item.
- (2) Type of installation for this test.
- (3) Auxiliary equipment required.
- (4) Description of operating cycle.
- (5) Description of preoperating procedures.
- (6) Description of method ignition.
- (7) Time elapsed between initial preparation and smoke production.
- (8) Number and training level of personnel required to install and operate equipment.

e) Operational data:

- (1) Noise level.
- (2) Fuel consumption and type.
- (3) Description of fuel containers.
- (4) Fuel additives for various temperatures.
- (5) Special procedures required for cold-weather operation.
- (6) Operating time for one complete fuel load.
- (7) Length, width, height, opacity, and duration of smoke cloud.
- (8) Electrical power input.
- (9) Operating pressures.
- (10) Flow rates.
- (11) Type of operating fluid.
- (12) Nozzle characteristics.

2) At the completion of operational reliability tests, record the following:

- a) Number of smoke generators tested
- b) Number of nonfunctioning generators
- c) Reason for nonfunctioning or malfunctioning, if known

b. Retain all photographs

6.3.9 Dissemination Characteristics

a. Record the following:

- 1) Data collected as described in applicable sections of MTP 8-2-513.
- 2) Description of sampling techniques.
- 3) Results of sampling and analysis.
- 4) Description of smoke screen and dispersion characteristics.
- 6) Lighting relationship of observers (cameras) smoke screen, and illumination source.
- 7) Photometer readings of incident and reflected light from cloud and background.
- 8) Type of background (tree, rock, water, etc.) and color.
- 9) Type of surface in foreground and beneath smoke screen (soil, rock, water, grass, etc.) and color.
- 10) Meteorological data consisting of:
 - a) Temperature and temperature gradient
 - b) Barometric pressure
 - c) Wind velocity
 - d) Relative humidity
 - e) Cloud conditions

b. Retain all photographs.

6.3.10 Maintenance Characteristics

a. Record the following:

- 1) Any deficiencies:
 - a) In maintenance package
 - b) Of test item requiring component replacement
- 2) The time required to perform scheduled and unscheduled maintenance.
- 3) Special tools required.
- 4) Features of design enhancing maintenance by personnel of average skill.
- 5) Component interchangeability.
- 6) Adequacy and accuracy of maintenance documentation.
- 7) Maintenance category of the test item.
- 8) Nomenclature of repair parts used.
- 9) Test item down time (cumulative).
- 10) Time taken between repairs and reasons, if appropriate.
- 11) Frequency of repairs.

b. Retain all photographs

6.3.11 Human Factors Aspects

Record the following:

- a. Compatibility with field clothing and equipment, particularly with protective clothing, arctic clothing, etc.
- b. Simplicity and adequacy of operating instructions.
- c. Conformance of the test item's design to qualitative requirements, particularly whether it is as compact and light as possible commensurate with functional characteristics.
- d. Legibility of identification markings.
- e. Reactions of test personnel to design features when operating equipment.
- f. Ease of identifying items and components under daylight, darkness, and blackout conditions.
- g. Need for special tools or special handling.

6.3.12 Electromagnetic Radiation (EMR) Vulnerability Test

Record the following:

- a. Frequencies where EMR effects shall most likely occur
- b. Polarity of radiated signal
- c. Temperature of the EED bridgewire

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Receipt Inspection

- a. Data collected as a result of this procedure shall be presented as indicated in the applicable portions of MTP 8-2-500.
- b. The description of the test item, number of items tested, and conditions upon receipt shall be presented in tabular form.
- c. Photographs shall be used to substantiate results.
- d. The results of the leak and operational check tests shall be presented in narrative or other convenient form.

6.4.2 Safety Evaluation

- a. A Safety Release Recommendation as required by USATECOM Regulation 385-6 shall be forwarded to the U. S. Army Test and Evaluation Command within 30 days of the beginning of the test. The Safety Release Recommendation shall describe special safety considerations or hazards to personnel and materiel, including development types of equipment as well as standard components, used in assemblage of item being tested.
- b. Report data and comments relative to the safety hazards observed during any phase of testing.
- c. Report comments relative to suggested safety improvements.

6.4.3 Simulated Environmental Testing

- a. The results of the subtests conducted shall be presented in tabular or other suitable form.
- b. The results of the leak and/or operational check tests performed at the conclusion of the various environmental tests shall be presented in narrative or other suitable form.

6.4.4 Rough Handling and Surface Transport Tests

- a. Rough handling and surface transport data shall be presented as prescribed in MTP 8-2-503.
- b. Vibration and shock data will be presented in tabular form to indicate test times, distances dropped, shock levels, vibration frequencies etc., and significant findings of the test. Include photographs of damage.
- c. Present data on operation of test item after subjection to rough handling and surface transport conditions, vibration and shock.

6.4.5 Air Transportability

Data shall be presented in summary form as indicated in the applicable portions of MTP 7-1-002, MTP 7-2-515, and other pertinent testing instructions.

6.4.6 Airdrop Capability

- a. Present the results of the free fall test in narrative form.
- b. The results of the airdrop container subtest shall be presented as prescribed in the applicable portions of MTP 7-2-509.

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6.4.7 Leak Testing

- a. The results of leak testing shall be presented as prescribed in MTP 8-2-512.
b. Narrative comments, photos, etc., shall be included as required.

6.4.8 Operational Reliability

Data derived from this subtest shall be presented in narrative form supplemented by drawings, photographs, charts, tables, graphs or any other suitable means of displaying information. The report shall clearly conclude whether the test item meets the reliability criteria established in applicable specifications. Recommendations relative to further testing and methods to overcome malfunctions will also be included.

6.4.9 Dissemination Characteristics

- a. The results of this subtest shall be presented as prescribed in MTP 8-2-513.
b. Drawings, tables, charts, photographs, or other means of presentation shall be included to report sampling techniques, sampling results, etc.
c. Narrative comments shall be included, as required.

6.4.10 Maintenance Characteristics

Data from this subtest shall be presented in narrative form. The report shall be supplemented by photos, drawings, or other devices to substantiate the conclusions and recommendations.

6.4.11 Human Factors Aspects

- a. Data from this subtest shall be presented in tabular, narrative or other suitable form supplemented by photographs and graphic or art presentations as required.
b. A summary of comments regarding shortcomings and recommended improvements shall be presented.

6.4.12 Electromagnetic Radiation (EMR) Vulnerability Test

Data from this subtest shall be presented in tabular, narrative or other suitable form supplemented by photographs and graphic or art presentations as required.

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